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Impact of a Simulation-Based Pedagogy in Entrepreneurship Education: Comparative Insights from Germany, Spain, Thailand and China

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Abstract: The objective of the present paper is to evaluate an entrepreneurship education pedagogy that involves computer-based start-up simulations. In a longitudinal study with 163 university students in Germany, Spain, China, and Thailand, we analyzed the impact on the participants' entrepreneurial intentionality, perception, risk assessment, knowledge, and enthusiasm. Above all, we found a positive effect of the applied educational concept. However, in a discriminate analysis we also learnt that the impact depends on the cultural context where the pedagogy is inserted. Moreover, prior entrepreneurial attitude and knowledge as well as gender are influential. In conclusion, we recommend entrepreneurship educators to keep the participants' educational and cultural background in mind when developing and implementing an entrepreneurship education program.

Keywords: entrepreneurship education; simulations; universities; teaching methods; evaluation; impact measurement.

1. Introduction

In recent years, higher education institutions all over the world have greatly changed. Their traditional education scheme was teaching-oriented, aimed at

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imparting theoretical and specialist knowledge, and was mainly destined to prepare students for working in large companies. Now, universities are expected to fulfill new and amplified functions: They are challenged to endow their students actively with the appropriate knowledge and abilities for business creation, often articulated as relevance or the third mission of universities (Gibb 1996; Johannisson, Handström, and Rosenberg 1998; Etzkowitz et al. 2000). Hereby, universities must convey a broad range of technical, social, and conceptional skills on how to start and run a business, considering that both personality and management skills are key elements for success. This goes hand in hand with setting an entrepreneurial mind, raising awareness of business opportunities, and thinking in global markets.

Consequently, entrepreneurship education (EE) at higher education institutions has gained importance in a scientific, economic, and political context. Although there were some earlier initiatives, the implementation of the modern EE dates back to the 1980s in the United States, and the 1990s in Europe. From those points on, courses and programs have been implemented at all levels of education and in many countries. At the same time, scholars have presented a variety of different concepts about EE, and their heterogeneity is abundant. The analysis of specific EE programs in literature that we conducted (cf. for the most recent Collins et al. 2006; Fayolle et al. 2006; Smith et al. 2006; Okudan and Rzasa 2006; Boyle 2007), general reviews (e.g. Gorman et al. 1997; Carayannis et al. 2003; Hannon et al. 2006; Pittaway and Cope 2007a; Solomon 2007), as well as practical experience indicate that little uniformity exists regarding philosophy and pedagogy. In fact, it seems as if this field is still in its infancy, as Brockhaus et al. (2001) already rightly stated.

Within the different research lines in EE, in this paper we focus on the instruments and methodologies for teaching entrepreneurship in order to prepare students for business creation. Despite the vast literature about composition and structuring of EE programs, only a few studies targeted the measurement of their pedagogic impact, with a growing interest in recent years. Herein, EE evaluation is mostly focused on the United States (e.g. Clark et al. 1984; van Clouse 1990; Mitchell and Chesteen 1995; Charney and Libecap 2000; DeTienne and Chandler 2004) and Western Europe (e.g. Hansemark 1998; Carayannis et al. 2003; Schröder and Schmitt-Rodermund 2006; Souitaris et al. 2007; Matlay 2008; Oosterbeek et al. 2008). Furthermore, some analysis in Australia were made (e.g. Peterman and Kennedy 2003). There is, as far as we know, almost no study that analyzed the impact of EE in Asian countries or in comparison with them. Exceptions are Lee et al. (2005), who firstly examined the United States and Korea, and Lee et al. (2006) later expanded the scope by including China and Fiji as well. Nevertheless, many of these works applied cross-sectional or retrospective techniques, which are not appropriate to provide convincing evidence for the effect of EE. Following Souitaris et al. (2007) line of reasoning, there is a clear need for empirical studies in this respect.

In the present paper, our research addresses the effectiveness measurement of a simulation-based EE pedagogy. The central element consists in the use of a computer-based start-up simulation, an experiential-based tool that includes both theoretical and practical aspects of training for business creation. Such simulations cover the whole start-up process by providing an environment close to the real business world, but without incurring the cost, risk, or complexity of real-life situations (Feldman 1995). Only a handful of researchers have attended to the subject until now, hereunder Low, Venkataraman, and Srivatsan (1994), Wolfe and Bruton (1994), Feldman (1995), Thavikulwat (1995, 1999), Brawer (1997), Schwartz and Teach (2002) and Hindle (2002).

In particular, empirical evaluation of simulations' impact on molding the participants' entrepreneurial mindset and knowledge is almost absent from the literature. To our knowledge, no study explicitly scrutinized over time the pedagogic effect of EE methods that involve computer-based start-up simulations. Therefore, we think that is important to address this issue by tackling a longitudinal study to overcome the methodological limitations of the existing studies and to offer a cross-cultural comparison. The objective of our paper is to advance EE theory by evaluating and measuring the impact that an EE pedagogy involving computer-based start-up simulations can exert on entrepreneurial intentionality, perception, risk assessment, knowledge, and enthusiasm. Furthermore, we investigate whether some specific determinants such as country, expectations on the course, prior attitude and knowledge, as well as previous entrepreneurial experiences could influence this impact.

The remainder of the paper is structured as follows: Next section reflects about EE definitions, objectives, and pedagogies. It also refers to the importance of computer-based start-up simulations and explains the simulation-based pedagogy on which our study is based. Following this, in section 3, we develop our hypotheses to be empirically tested, and elucidate the respective measures. Section 4 describes the methodology, i.e. data gathering and sample composition. Afterwards, in section 5 we present the results and discuss our findings. The last section highlights the theoretical contributions, implications, and limitations of our study.

2. Theoretical Concept and Practical Application

2.1. Entrepreneurship Education

Despite EE courses and programs having proliferated in the last few decades at all levels of education and in most countries, little consensus exists about the pedagogic instruments and methodologies. There are conventional forms of teaching, conveying 'hard facts' about entrepreneurship, and fostering business

acumen (Plaschka and Welsch 1990; van Clouse 1990; Krueger and Brazeal 1994; Young 1997). Hereby, content is mainly focused on the functional management disciplines, the so-called 'know-what'. The key pedagogies are lectures, business plan development, and case study analysis, and the role of the teacher is predominant. Referring to this type of EE, Ronstadt (1985, 1990) speaks from 'Old School' methodologies.

In addition, several scholars claim that EE must target motivation and social competencies for rolling out new ventures, incorporating soft fact dimensions like the appropriate 'know-how' (Hood and Young 1993), 'know-who' (Gibb 1996), and 'know-why' (Johannisson 1991). More concretely, McMullan and Long (1987), and Vesper and McMullan (1988) demand that EE must include skill-building components in negotiation, leadership, creative thinking, and exposure to technological innovation. Ronstadt (1990) stresses, amongst other things, skills such as creativity, ambiguity tolerance, opportunity identification, venture strategy, deal making, and networking. In addition to these attributes, Rae (1997) emphasizes communication skills with focus on persuasion and, furthermore, critical thinking, problem solving, and time-management. For networking skills, Gibb (1996) underpins the importance of social linkages and stature. Boyle (2007) highlights that attributes such as creativity, persistence, and innovation need to be identified, nurtured, and freely expressed in the classroom. Johannisson (1991) places emphasis on entrepreneurial values, goals, self-confidence, and perseverance. In the same vein, Gibb (2007) places key importance on motivation towards entrepreneurial values and on getting closer to the notions of entrepreneurial doing, thinking, feeling, communicating, organizing, and learning.

Though imperative, such tacit elements are difficult to convey and their inclusion in EE programs is still dilatory. 'Old School' methodologies remain to be the most widespread concept in contemporary EE. Chen, Greene, and Crick (1998) confirm that current EE tends to focus rather on the technical aspects of entrepreneurship, and according to Kirby (2004), the focus on developing entrepreneurial skills and behavior falls short. Consequently, Blenker et al. (2008) dispute that the present educational system is capable of increasing the students' motivation and competences on entrepreneurship. They argue that, at present, universities have not mastered yet the necessary learning methods, pedagogical processes, and frames for EE.

In their quest for appropriate methodologies, a vast variety of pedagogic approaches exists, and there exhaustive discussion would go beyond the scope of our paper. In general, EE literature highlights active partaking of the participants in discussions and giving instant feedback, rather than rigid and passive-reactive approaches. Project based and experiential learning are, therefore, found to be advantageous and used with an increased intensity (Sexton and Bowman-Upton 1987; Hills 1988; Plaschka and Welsch 1990; Solomon and Fernald 1991; Robinson 1996; Daly 2001; Hindle 2002; Pittaway and Cope 2007b).

Experiential learning is expected to accelerate the pedagogic effect, since motivation is increased and emotional and intuitive dimensions of entrepreneurship are experienced. Moreover, modern EE increasingly uses action-based learning concepts (Leitch and Harrison 1999; Rasmussen and Sørheim 2006). It should be designed as close to reality as possible, emulating contexts similar to those in which entrepreneurs act (Plaschka and Welsch 1990; Hindle 2002; Carayannis et al. 2003). Accordingly, Ronstadt (1985, 1990) refers to the 'New School' of EE, and Gibb (1993) called such pedagogies the 'Enterprising learning mode'.

2.2. Simulations in Entrepreneurship Education

Within the above-mentioned methodologies, simulations are increasingly important. In a general view, Keys and Wolfe (1990) describe a simulation as a simplified situation that contains enough similarities with reality to elicit real-world responses from the participants. Thereby, the participants unconsciously process all types of information including emotions, relationships, strategies, and feelings (Petranek, Corey, and Black 1992). In EE, simulations are an experiential methodology concatenating both theoretical and practical aspects of training for business creation, with particular concentration on molding entrepreneurial behavior.

Generally, there exist two types of simulations, one computer-based, and another behavior-based. See for an example of the latter the writings of van Clouse (1990), Stumpf, Dunbar, and Mullen (1991), Robinson (1996), Ulijn et al. (2004), and Pittaway and Cope (2007b). Nevertheless, the focal point of this paper lies on computer-based start-up simulations. This pedagogy intends to model the whole start-up process by providing an environment close to the real business world. Computer-based start-up simulations offer both theoretical concepts and situational approaches (Brawer 1997) and simulate those economic forces that the entrepreneur must accommodate if success is to be achieved (Wolfe and Bruton 1994). Simulated seasonal variations, unexpected market occurrences, and the behavior and reactions of the other participating teams as competitors ensure a dynamic environment. In doing so, participants go beyond strategy formulation, implementation, and application and then make decisions at the tactical level consistent with their chosen strategy in a virtual dynamic and competitive atmosphere. They practice explicit knowledge in simulated real-life situations and train their social, conceptual, and entrepreneurial skills. Usually, in simulations the participants act in teams, and their interdisciplinary and international composition may additionally enhance the educational effect.

The advantages of computer-based start-up simulations in EE are manifold: In this experiential learning model, participants are exposed to the same types of behaviors evidenced by entrepreneurs in their day-to-day business (Feldman

1995). In spite of the realistic environment, the complexity of real business situations is reduced and participants operate in a risk-free and safe context (Feldman 1995). Thus, an important benefit is that the participants can prove and practice their entrepreneurial knowledge, abilities, skills, and competencies in a concentrated amount of time before testing them in a real business environment. Computer-based start-up simulations confer multiple experiences of new venture decision making under uncertainty (van Clouse 1990; Feldman 1995) and offer instant feedback, which makes the learning process more realistic compared to case analysis (Brewer, Anyansi-Archibong, and Ugboro 1993). Moreover, Keys and Wolfe (1990) and Brewer et al. (1993) accentuate the importance of the competitive element, which increases interest, involvement, excitement, and enthusiasm.

In light of these arguments, several authors advocate the great potential of computer-based start-up simulations in EE (e.g. Klandt 1994; Wolfe and Bruton 1994). However, Brawer (1997) alerts that such simulation should rather be embedded in a larger concept of EE. The task is, following the suggestions of Lourenço and Jones (2006), to design a collaborative model of EE that combines traditional and alternative pedagogies. Taking into account the ongoing globalization of economies, the international dimensions of entrepreneurship should be a further component of such new types of EE (Bell et al. 2004). The next section introduces one of these attempts being the basis for subsequent EE impact measurement.

2.3. The STARTSIM Project

Within the project "STARTSIM", we implemented and ran simulation-based courses with competitions at an international level. The universities involved were Ilmenau University of Technology (Germany), University Miguel Hernández in Elche (Spain), Tongji University in Shanghai (China), and Burapha University in Chonburi (Thailand). As for the simulation software, we used a field-tested and ready-to-use-solution. The decision fell on "TOPSIM® - easyStartup!" simulation software from UNICON resp. TERTIA Edusoft Company[2] which is a common provider in management simulation software in Germany.

The simulation courses consisted of three stages. During the first phase, participants received a lecture on how to develop a business plan; they were also introduced to the simulation and the scenario. Then, in the second phase, they gathered and evaluated information about the market through a simulated internet. After that, participants wrote a complete business plan based on the data

2. Further details about the simulation software can be found at http://www. topsim.com

placed at their disposal and negotiated funding. At the end of the second phase, they analyzed the outcomes with the trainers in a classroom discussion.

In the third phase, the so-called 'competition phase', the teams ran their venture in a virtual competitive environment and competed against each other. In doing so, they developed and implemented their strategic plan and made decisions at the tactical level in up to six cycles. Hereby, each cycle corresponds to one financial year, so that the simulation covers the first six years of the new venture's existence. Between each cycle and at the end of the simulation, the teams had access to each other's interactions and results from the cycle completed; they also discussed the outcomes with the trainer.

We operated the simulation courses in a three-day full-time seminar, with approximately 25 contact hours. Each course consisted of up to five teams comprising two to five people, so that participants took decisions in groups. Before running the simulations locally and internationally, we organized a series of train-the-trainer meetings, in order to jointly prepare and instruct the trainers and ensure a homogeneous level of knowledge about software handling. Subsequently, a pilot course with the trainers acting as participants was executed to provide them with 'real' experience on how the simulation functions.

While the first simulation courses were offered at the local level at each partner institution, the later cross-border competitions with teams from different countries and the subsequent comparison of the results represent the main feature of the STARTSIM project. The advantages of the applied pedagogy rest upon the combination of lectures, classroom discussions and experiential 'learning by doing' activities, linking business theory and practice, a realistic simulation of start-up activities and, in particular, on the international dimension. To analyze its impact and to gain insights on its effectiveness, we constructed a series of hypothesis, shown by the following section.

3. Formulation of Hypotheses

To start with, due to the multifaceted effects that EE could cause, no study has yet measured the overall usefulness and effectiveness, towards individuals and society, of educating individuals to become entrepreneurs. Moreover, although a variety of practitioners, educators, and policy-makers recite the alleged benefits of EE like a mantra, little rigorous research actually exists, and the conviction of the positive outcome seems often more ideologically than empirically grounded, as Peterman and Kennedy (2003) rightly alert.

Nevertheless, several researchers have attempted to capture and measure the EE impact. Hereby, 'impact' can be interpreted as a change in miscellaneous aspects related to entrepreneurship, such as the EE participant's intentionality, desirability, willingness, perception, risk assessment, feasibility, confidence, skills, ability, and knowledge as variables of the pedagogic effect. It is worthy of

notice that impact can also mean developing a sense of certainty about whether or not starting a business by detecting shortcomings within the before-mentioned items.

Then again, there are more tangible effects, i.e. economic outcomes measuring entrepreneurial success, such as propensity of start-up activities, survival rate, new venture's performance and market share, employment and sales growth, and economic development. See for the latter the works of Clark et al. (1984), McMullan, Long, and Graham (1986), McMullan and Long (1987, 1990), McMullan and Gillin (1998), and Charney and Libecap (2000). Of course, both types of effects cannot be scattered and viewed as separate components; rather there exists a linkage spanning from the pedagogic to the economic impact. The former does not generate an economic effect per se, but it is a pre-condition for that.

The pedagogic impact of EE, being the subject of our study, has more often been empirically scrutinized. Despite few exceptions (e.g. Oosterbeek et al. 2008), numerous scholars have discovered that exposure to EE significantly increases participants' entrepreneurial intentionality (Clark et al. 1984; Hatten and Ruhland 1995; Cho 1998; Lüthje and Franke 2003; Peterman and Kennedy 2003; Zhao, Seibert, and Hills 2005; Lee et al. 2005; Fayolle et al. 2006; Souitaris et al. 2007). In addition, the systematic literature review in the field performed recently by Pittaway and Cope (2007a) confirms that EE has a positive impact on student propensity and intentionality.

Moreover, researchers found EE to also have a positive impact on motivation (Clark et al. 1984), attitudes (Souitaris et al. 2007), and on perceptions of both desirability and feasibility (Hansemark 1998; Peterman and Kennedy 2003). In addition, entrepreneurial decision-making (van Clouse 1990), entrepreneurial self-efficacy (Zhao et al. 2005), venture expertise (Mitchell and Chesteen 1995), as well as confidence, knowledge and ability with respect to venture creation (Lee et al. 2005) are likely to be increased by EE. With regard to specific personality traits, Hansemark (1998) reported that participants in an entrepreneurship program developed a higher level of need for achievement and a greater internal orientation of locus of control, compared with those who did not take part. DeTienne and Chandler (2004) provided empirical support for the assumption that their specific EE program had an influence on students' abilities to generate a higher number and more innovative business ideas.

Easy to recognize, studies typically examine student intentionality. However, within the range of items that may capture the pedagogic impact, besides intentionality we think that outcomes such as an increased entrepreneurial perception, risk assessment, knowledge, and enthusiasm are decisive when it comes to the decision of whether or not to create a new venture. Our first hypothesis would thus be:

H1. The simulation-based pedagogy exerted a positive impact on entrepreneurial intentionality, perception, risk assessment, knowledge, and enthusiasm of the participants.

In determining the influence of specific variables on the expected impact, Carayannis et al. (2003) point out that, in general, intentionality is embedded in cultural contexts, influenced by perceived and real barriers. Because of each country's unique cultural context, the impact of EE may vary considerably, as Lee and Peterson (2000) and Lee et al. (2005, 2006) state. This seems particularly true for Asia in comparison with Europe or North America. Lee et al. (2005) also revealed an inverse relation between the development of one country's entrepreneurial culture and the impact of EE. Consequently, we assert:

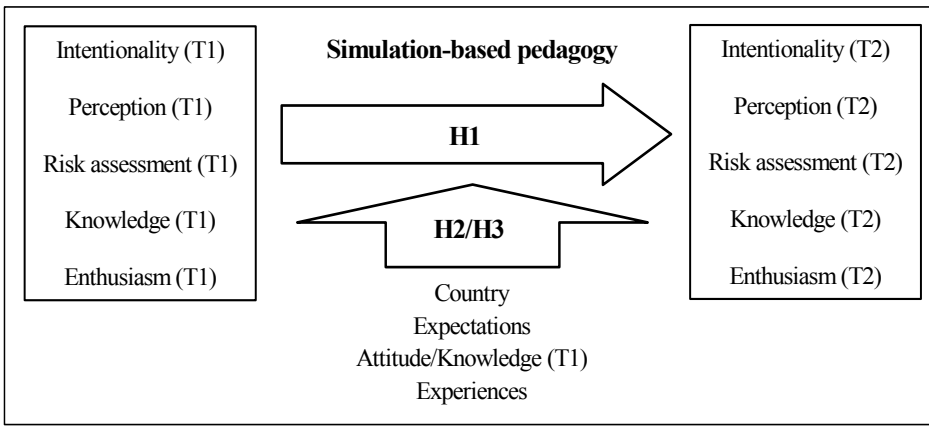
H2. The impact of the simulation-based pedagogy varies between the countries studied.

Based on these premises, a set of variables are supposed to bias the pedagogic effect. Hereby, we assume an influence of personal expectations as well as of the entrepreneurial intentionality, perception, risk assessment, knowledge, enthusiasm, and experiences that individuals have had before their participation in the course. Likewise, Pittaway and Cope (2007a) suggest that studies on intentionality may benefit from incorporating contextual factors and taking a more sociological perspective. Zhao et al. (2005) argue that previous entrepreneurial experience can be seen as a form of enactive mastery and role modeling, so that we believe that this seems to influence the outcomes of an EE program. Hence, our third hypothesis is:

H3. The impact of the simulation-based pedagogy depends on the country, on the participants' expectations on the course, on their prior entrepreneurial attitude and knowledge (i.e. initial entrepreneurial intentionality, perception, risk assessment, knowledge, and enthusiasm), as well as on their previous entrepreneurial experiences.

To illustrate these assumptions, Figure 1 visualizes the hypotheses and their linkages.

Figure 1: Model with variables and arrows representing the hypotheses



4. Methodology

4.1. Data Source

Our study relies on the evaluation of a number of simulation-based EE courses that were organized within the project "STARTSIM". To analyze the educational impact and the influence of specific variables over the course period, we applied a longitudinal study, conducting two waves of data collection. The methodology consisted of a pretest-posttest questionnaire (Cohen, Manion, and Morrison 2007) with self-reported answers. Such instrument was used by several authors to measure the pedagogic impact of EE (van Clouse 1990; Mitchell and Chesteen 1995; Hansemark 1998; Peterman and Kennedy 2003; Carayannis et al. 2003; DeTienne and Chandler 2004; Zhao et al. 2005; Schröder and Schmitt-Rodermund 2006; Souitaris et al. 2007).

Therefore, we designed two types of questionnaires, one, which was to be completed at the very beginning of the course (pretest) and another one that was to be answered at the end (posttest). Both questionnaires consisted of two identical parts. Additionally, the pretest questionnaire contained a third section assessing the participants' expectations on the course and their entrepreneurial experiences. The first part gathered general information such as date, university, nationality, age, gender, and course of study. Students were asked to indicate a name or acronym to ensure correct assignment of the pre- and posttests.

The second part, being the key element of the questionnaire, measured entrepreneurial intentionality, perception, risk assessment, knowledge, and enthusiasm. It enclosed a series of statements to both detect and analyze the individuals' opinion towards the terms presented. The statistically robust

variation (or lack of variation) between the pretest and the posttest scores should provide insights into the effectiveness of the educational concept. For this purpose, we applied five-point Likert-type scales. A five-point scale was adopted because we believed that more numerous response categories would exceed the respondent's ability to discriminate, with the likelihood that 'noise' rather than more precise data would be a result. The third part of the pretest questionnaire employed single item measures ('yes' vs. 'no') to assess expectations on the course and entrepreneurial experiences.

4.2. Sample Composition

Concretely, the simulation courses we analyzed were run at the partner universities in Germany, Spain, Thailand, and China within a one and a half year period, spanning from November 2006 to April 2008. Altogether, we obtained, matched, and analyzed 163 pairs of questionnaires (each with one pretest and one posttest questionnaire). Identity of the respondents in both questionnaires was guaranteed by conferring name or acronym, and additionally by comparing other general information. Individuals who did not return both parts of the questionnaires were excluded from the study. Unfortunately, as not all students filled out both questionnaires completely, a few answers to some statements are missing.

Our sample consisted of 55 participants in Germany, 13 in Spain, 63 in Thailand, and 32 in China, which corresponded to a distribution of 33.7 %, 8.0 %, 38.7 %, and 19.6 %, respectively. Most of the participants, namely 52.8 %, were between 21 and 24 years old, 27.6 % aged 25 or more, and 19.6 % were younger than 21 years (mean = 23.49, s.d. = 4.955). 54.6 % of participants were male. The courses of study represented in our sample were business administration, engineering, media sciences, and tourism.

For understanding and interpreting the potential outcomes, it is necessary to analyze the sample composition with regard to the participants' expectations on the course, their entrepreneurial intentionality, perception, risk assessment, knowledge, enthusiasm, and experiences before running the course. As shown by Table 1, we found a number of distinctive features between the subgroups in Germany, Spain, Thailand, and China. This is particularly true for all measures related to the initial entrepreneurial attitude, knowledge, and experiences, but also for some aspects within the expectations on the course.

Table 1: National differences in expectations on the course, prior attitude and knowledge, and entrepreneurial experiences

Variables	Chi²-Test Country	Percentage Germany n=55	Percentage Spain n=13	Percentage Thailand n=63	Percentage China n=32
Expectations on the course					
Until now, I do not have expectations on the simulation course.	ϕ^2=6.74	10.91%	0.00%	20.63%	6.25%
I have not yet considered the possibility to start a business, but I am interested in this topic.	ϕ^2=10.93*	40.00%	15.38%	15.87%	37.50%
I could imagine starting a business, but I am not sure if I should do it.	ϕ^2=2.99	32.73%	38.46%	46.03%	31.25%
I want to start a business and I expect to get information and skills about it.	ϕ^2=1.24	23.64%	38.46%	25.40%	25.00%
I have already started a business and I want to improve my knowledge and skills.	ϕ^2=27.80**	1.82%	7.69%	30.16%	0.00%
Prior entrepreneurial attitude and knowledge					
Intentionality (>3)	ϕ^2=29.56**	21.82%	38.46%	39.69%	60.00%
Perception (>3)	ϕ^2=40.88**	24.07%	46.15%	63.49%	35.49%
Risk assessment (>3)	ϕ^2=29.32**	5.45%	15.38%	28.57%	25.00%
Knowledge (>3)	ϕ^2=23.01**	9.26%	7.69%	12.70%	3.13%
Enthusiasm (>3)	ϕ^2=30.82**	31.48%	0.00%	28.57%	21.88%
Prior entrepreneurial experiences					
Existence of a concrete business idea	ϕ^2=38.44**	34.55%	53.85%	83.61%	28.13%
Participation in business creation seminars	ϕ^2=15.87**	25.45%	30.77%	60.66%	37.50%
Preparations done for business creation	ϕ^2=26.19**	18.18%	30.77%	59.02%	18.75%
Already started up a business	ϕ^2=59.25**	5.45%	7.69%	57.38%	0.00%
Control variables					
Age (>24)	ϕ^2=94.14**	20.00%	69.23%	31.75%	15.63%
Gender (male)	ϕ^2=47.27**	81.82%	38.46%	23.81%	75.00%

Notes: Pearson chi-square was used to test for association; * $p < 0.05$; ** $p < 0.01$.

4.3. Data Measurement and Coding

As referred, in our study we interpret and measure 'impact' as a change in entrepreneurial intentionality, perception, risk assessment, knowledge, and enthusiasm. Therefore, the dependent variables are the changes in these attributes over time, comparing their values at the beginning of the course (T1) and at its end (T2). The independent variables in our model are country, the participants' expectations on the course, their entrepreneurial intentionality, perception, risk

assessment, knowledge, enthusiasm, and experiences they possessed when starting the seminar (T1). As control (dummy) variables we consider age and gender.

Hereby, we conceive *entrepreneurial intentionality* as a sociological and psychological construct. According to Bird (1988) and Krueger (2000), it is central to entrepreneurship. Similarly to Shapero (1975), Krueger (1993), and Peterman and Kennedy (2003), we define intention as a predictor of planned behavior embracing interest, desirability, and conviction for starting a business. It also includes the wish for professional independence. In our study, we measured intentionality through a combination of four statements.

Entrepreneurial perception is the process of attaining understanding and awareness about entrepreneurial endeavors. It stands for judging the ease and feasibility of creating a business. This construct also comprises the ability to evaluate its potential success and to perceive facilitating factors. We used four statements for gauging.

Again, *entrepreneurial risk assessment*, a key entrepreneurial function (Palmer 1971), is the individual's judgment on the likelihood of failure in uncertain decision-making contexts. It is the valuation of situations of risk with the right balance and the sense of control over outcomes. In this, individuals dominate anxiety about an entrepreneurial venture and are able to draw objective conclusions. Here, we employed two statements to capture the risk assessment measure.

For *entrepreneurial knowledge*, we define it to be 'hard facts' on business creation. It comprises mastering the indispensable management techniques and tools. For Young (1997), the utility of entrepreneurial knowledge lies in its value for increasing a new ventures' effectiveness. Two statements were used as measures for knowledge.

Finally, we interpret *entrepreneurial enthusiasm* as a whole-hearted devotion to entrepreneurial activities, as visible enjoyment or excitement about starting a business. For measurement purposes, this construct consisted of three statements.

The Appendix illustrates the statements we used in the questionnaire to capture the constructs before stated.

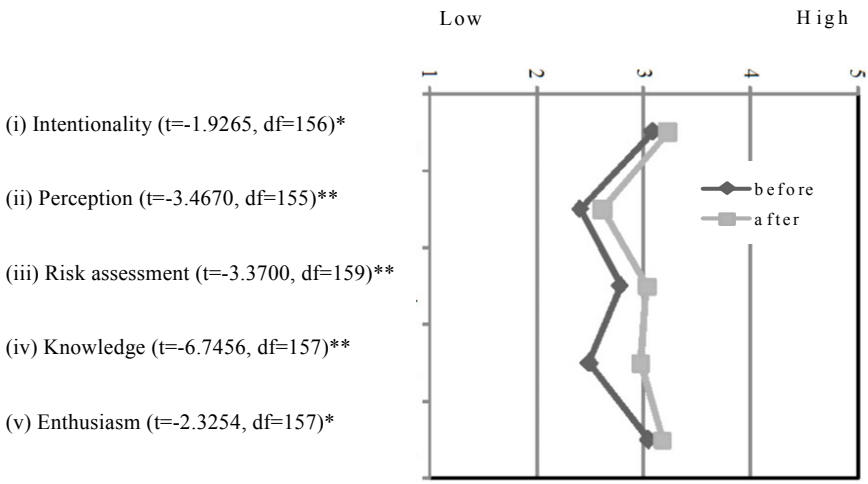
5. Results and Discussion

5.1. Pedagogic Impact

The main objective of this paper is to find out whether the simulation-based EE pedagogy could positively influence the participants' entrepreneurship-related attitude and knowledge. More concretely, the target is to analyze whether the method was able to cause a change in the specific variables we applied to measure

the pedagogic impact. Within these attributes, in detail we focused on a potential variation with regard to entrepreneurial (i) intentionality, (ii) perception, (iii) risk assessment, (iv) knowledge, and (v) enthusiasm, comparing the respective variables before and after the participants attended the start-up simulation courses. Figure 2 highlights the respective differences between the pretest and the posttest questionnaires with respect to the total sample. To test differences, we applied t-test. T-values are also shown in Figure 2, and statistically robust changes that occurred while running the course are signalized.

Figure 2: Impact of the simulation-based pedagogy on entrepreneurial (i) intentionality, (ii) perception, (iii) risk assessment, (iv) knowledge, and (v) enthusiasm



Notes: t-test was used to test for difference; * $p < 0.05$; ** $p < 0.01$

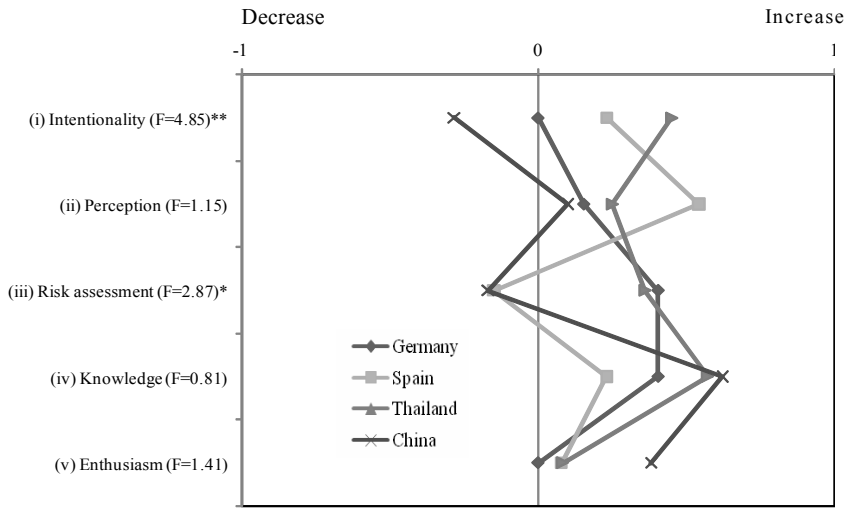
Thus, in the overall sample, for all measures there is a significant positive change. Therefore, the results give support for our first hypothesis. However, we expect that a discriminate scrutiny of influential factors will reveal some meaningful insights, exposed in the following sections.

5.2. Country Specific Differences

Next step of our analysis is to detect national differences in the impact of the applied EE pedagogy. Therefore, the differences between the mean scores in the statements of the posttest and the pretest questionnaires were calculated. Figure 3 shows the impact of the simulation tool, classified by countries. One-way ANOVA was used to test for significance and F-values are given in Figure 3. The

results reveal variations among the impact on (i) intentionality and (iii) risk assessment.

Figure 3: Impact of the simulation-based pedagogy on entrepreneurial (i) intentionality, (ii) perception, (iii) risk assessment, (iv) knowledge, and (v) enthusiasm, by countries



Notes: ANOVA was used to test for difference; * $p < 0.05$; ** $p < 0.01$.

In order to detect which of the variations contribute most to the significance, we performed an ordered logistic regression for each dependent variable, including three country dummies with Germany as the reference group. We also included control variables such as age and gender. Table 2 shows the results.

Putting the results from Figure 3 and Table 2 together, we found that students from Thailand experienced a soundly positive impact on their intentionality (i) compared to their counterparts from Germany. Conversely, participants from China had a significant lower level of risk assessment (iii) after the end of the simulation course. Consequently, our second hypothesis, in which we supposed that the impact of the simulation-based pedagogy varies between the countries studied, was partially confirmed.

Nevertheless, at this point we only know that the pedagogic impact sometimes vary among the four countries (Figure 3 and Table 2). What remains to be tested is whether the effects are really caused by the countries' specific cultural contexts or are triggered by other mediating variables, such as the participants' expectations on the course, their prior attitudes and knowledge, or their previous entrepreneurial experiences (cf. Table 1). This leads us to verify our third hypothesis, which considers the conjunction of the possible influencing variables mentioned before.

Table 2: National differences in the pedagogic impact of the course

Variables	(i) Impact on intentionality	(ii) Impact on perception	(iii) Impact on risk assessment	(iv) Impact on knowledge	(v) Impact on enthusiasm
Country					
Spain	0.0497	1.3410	-1.1085	-0.8565	0.3060
Thailand	1.0958**	0.5337	-0.0213	0.0612	0.2490
China	0.1371	-0.2317	-1.0262*	0.5845	0.6767
Control variables					
Age	0.7542**	-0.1324	-0.0342	0.3848	-0.2830
Gender	0.2364	0.4727	0.2671	-0.2360	0.2526

Notes: Ordered logistic regression was used to test influence; * $p < 0.05$; ** $p < 0.01$.

5.3. Influences on the Pedagogic Impact

To test the specific influences on the pedagogic impact, we run a multivariate regression analysis (Ordered Logistic Regression) for each dependent variable. Table 3 visualizes the estimated coefficients and their level of statistical significance.

A heterogenic picture is formed through the effect of the countries' cultural contexts. For participants from Thailand, the impact on perception (ii) und risk assessment (iii) is stronger than for students from Germany as the reference group. Hence, a direct country effect exists indeed, at least for these two measures. On the contrary, the overall effect on intentionality (i), exposed in Table 2, is no longer significant and appears to be rather caused by other mediating variables. The same applies for participants in China, who showed a significant overall impact on risk assessment (iii) in Table 2, so that the effect is also fully mediated by other explanatory variables. Again, for students in Spain, we found a robust negative country effect on entrepreneurial enthusiasm (v). Therewith we substantiate, yet for another subset of countries and for certain measures, the insights of Lee et al. (2005), who revealed that the impact EE varies according to each country's cultural setting.

Table 3: Influences on the pedagogic impact of the course

Variables	(i) Impact on intentionality	(ii) Impact on perception	(iii) Impact on risk assessment	(iv) Impact on knowledge	(v) Impact on enthusiasm
Expectations on the course					
Until now, I do not have expectations on the simulation course.	0.6615	1.0580	0.9384	0.6606	-0.1171
I have not yet considered the possibility to start a business, but I am interested in this topic.	0.3489	-0.9677*	0.7204	-0.1321	-0.4316
I could imagine starting a business, but I am not sure if I should do it.	0.8009*	0.3638	0.4969	1.1418**	-0.2900
I want to start a business and I expect to get information and skills about it.	0.8160	0.4572	-0.0675	0.8341*	0.2664
I have already started a business and I want to improve my knowledge and skills.	0.5148	0.8719	-0.0250	-0.7294	-0.2198
Prior entrepreneurial attitude and knowledge					
Intentionality	-1.8419**	0.0836	0.1391	-0.3124	0.2088
Perception	0.8674**	-2.6379**	0.4314	0.5897*	0.2990
Risk assessment	-0.1184	-0.1009	-1.859**	0.1872	0.2513
Knowledge	-0.4223	-0.2649	-0.1585	-2.3655**	-0.1189
Enthusiasm	-0.0590	0.1241	0.0902	0.3761	-2.5572**
Prior entrepreneurial experiences					
Existence of a concrete business idea	0.8018	0.2675	-0.1900	-0.2107	0.4361
Participation in business creation seminars	0.0861	0.2745	-0.0807	0.5992	0.7081
Preparations done for business creation	1.2082**	0.6102	0.4000	0.7504	-0.0243
Already started up a business	-0.4950	-0.5950	0.0238	0.2241	-0.8103
Country					
Spain	1.2705	1.4452	0.3113	0.1587	-2.1828**
Thailand	0.5885	1.4831*	1.2235*	0.4005	0.4613
China	0.8515	-0.1136	-0.5479	0.4190	0.5417
Control variables					
Age	0.2799	-0.1026	-0.1579	0.3146	-0.0959
Gender	0.6233	0.3942	0.4879	-0.2005	0.9607*

Notes: Ordered logistic regression was used to test influence; * $p < 0.05$; ** $p < 0.01$.

In respect of the other mediating variables in the model, we identified a number of interrelations. Participants who were not sure whether or not to step

into self-employment experienced a statistically significant positive effect on intentionality (i) and knowledge (iv). The latter also applies to those who wanted to start a business. Additionally, a negative effect on perception (ii) was uncovered among participants who had not yet considered the possibility of starting a business. With this, it seems that to a certain degree the expectations on the course interfere with the pedagogic impact.

We found evidence that the impact on attitude and knowledge depends strongly on the initial levels within these measures. More specifically, participants with poor initial entrepreneurial attitude and knowledge increased the respective measures much more compared to those who had already expressed certain entrepreneurial attitude and knowledge when starting the course. Conversely, we observed that a higher entrepreneurial perception at the beginning of the course leads to a greater impact on intentionality (i) and knowledge (iv).

With regard to the influence of prior entrepreneurial experiences, we only found one statistically robust relation. Concretely, participants who had already done some preparations for business creation experienced a stronger impact on intentionality (i). Moreover, we revealed a significant effect of the participants' gender on the pedagogic impact. Hereby, entrepreneurial enthusiasm (v) increased more consistently among male participants, i.e. they proved to be more excited about starting a business than females. Summarizing, these results support our third hypothesis, at least partially.

6. Conclusions and Implications

Our research has several implications for EE theory and practice. The issue was to evaluate a pedagogy that merges different best practice EE methods. These are traditional approaches such as lectures, discussions, and business plan development on the one hand, and experiential learning through simulations and 'learning by doing' in an environment close to the real world, on the other. The outstanding feature of STARTSIM lies in its international dimension, realized by cross-national start-up simulation contests.

When asking for personal feedbacks, participants quoted that the most attractive and stimulating aspect was the competition with the other groups. Hence, it appears to be true that the competitive element, emphasized by Keys and Wolfe (1990) and Brewer et al. (1993), bestows the simulation course a special attractiveness. In addition, the international competition with students from other countries as the key feature of STARTSIM was an extraordinary incentive for participation. Furthermore, most respondents acknowledged that the atmosphere in the simulation course was relaxed and unfolded an openhearted message, and they praised the good interaction with the teacher. Fun was cited very often, too. These are important premises for effective learning. The overwhelming majority expressed their willingness to take part again in such a simulation course; they

admitted to even recommend the course to their colleagues. This is perhaps the most important feedback, which stands for a general positive reaction to the applied methodology.

Of course, our main intention was to empirically evaluate the effectiveness of the pedagogic impact in a statistically rigorous manner, based on validated measurement tools. For this objective, we performed a longitudinal study employing a pretest-posttest design, and analyzed the influence of specific variables. Overall, we conclude that the applied simulation-based EE pedagogy is a beneficial contribution to modern EE in both industrialized and developing countries. In particular, the results show that it is a useful instrument, for not only raising awareness, willingness, desirability, and excitement for starting a business, but also for learning the 'hard facts' about business creation and understanding potential threats and risks associated with it. As already proposed by Lourenço and Jones (2006), we reiterate that entrepreneurship educators should combine different learning approaches in order to create new models of EE. Even if the positive outcomes of our pedagogy depend on a specific type of simulation software, the linking of traditional and innovative EE concepts appears to be fruitful.

When checking for influential factors through a discriminate analysis, we found prior entrepreneurial attitudes and knowledge to be predominantly significant. Furthermore, the expectations on the simulation course play a certain role for the pedagogy's impact. We conclude that participants who are interested in business creation, though with no or poor entrepreneurial attitude and knowledge, should particularly be targeted when applying the simulation-based EE. Contrariwise, more entrepreneurial 'expert' students or even business founders might require other educational concepts. In sum, the computer-based start-up simulation we used in our study is particularly appropriate for transferring basic knowledge and skills to entrepreneurially inclined people. With regard to gender, we revealed that the applied educational concept seems more applicable to male participants that were identified with increased entrepreneurial enthusiasm. They appear more likely to be inspired in a particular positive manner by the simulation-based learning tool.

Another important outcome is that the pedagogic effect is embedded in cultural contexts. Therefore, the simple translocation of the EE methodology is not advised. Dana (2001) rightly alerts that it is an erroneous belief that a program that works in one environment will necessarily have the same effect elsewhere. On the contrary, a customized adaptation on each country's unique idiosyncratic conditions is mandatory for effective EE, as already stated by Lee et al. (2006). Simulation-based EE pedagogies must be tailored to the regional conditions where they are intended to be implemented. This principally holds for setting priorities in the course contents, but also for the instructional material, trainer preparation, and course language.

Finally, our study has a number of limitations that sparks possibilities for future research. First, our findings are taken from specific local contexts with sometimes a small sample size. A generalization should be made cautiously in light of the influential factors we identified. For this reason, we suggest further research to detect similarities and disparities with other regions and/or other cohorts of participants. Second, the statements given by the participants are self-report responses to a questionnaire, which may result in self-evaluation bias. Third, our results refer to one specific product in the market of computer-based simulation software ("TOPSIM® - easyStartup!"). Of course, not all simulations are homogeneous, and we acknowledge that our results may be specific to that specific type and might not apply to other simulation software. Nevertheless, we hope that the insights of our study will inspire other scholars, and the combination of our and future works will surely allow valuable comparisons.

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Appendix: Constructs and Questionnaire Statements

Construct	Statements
Entrepreneurial intentionality	1. I want to be independent in my professional activities. 2. It could be interesting for me to create my own firm. 3. It is desirable for me to become self-employed. 4. I am convinced that self-employment is the right alternative for me.
Entrepreneurial perception	1. It would be hard to start my own business right now. 2. It would be easy for me to create a firm after completing my studies. 3. I am sure that I would succeed if I had my own firm. 4. I am certain about the success if I started my own business right now.
Entrepreneurial risk assessment	1. I can evaluate possible chances and underlying risks of new firm creation very well. 2. Creating and managing a firm signifies too much risk for me.
Entrepreneurial knowledge	1. I have sufficient knowledge about business creation. 2. I know enough to start my own business right now.
Entrepreneurial enthusiasm	1. I would love starting my own business right now. 2. I would be tense if I started my own business right now. 3. I would be enthused if I started my own business right now.